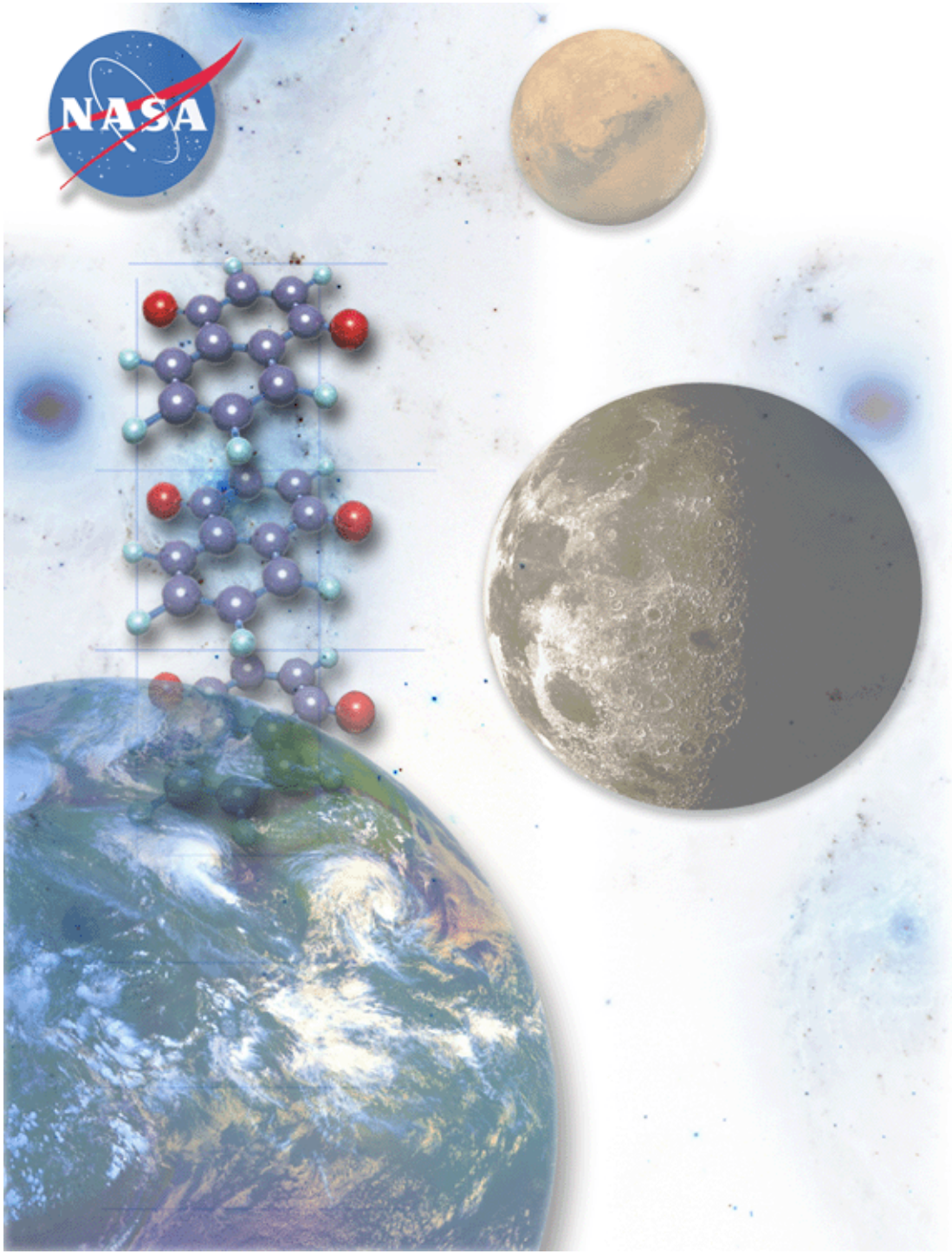


NASA Exploration Team

FY01 Annual Report

National Aeronautics and
Space Administration

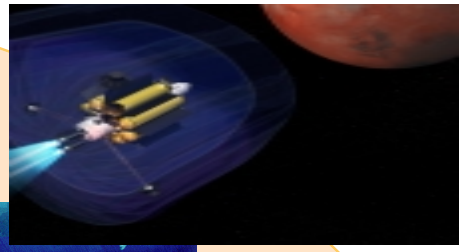
November 2001

Introduction

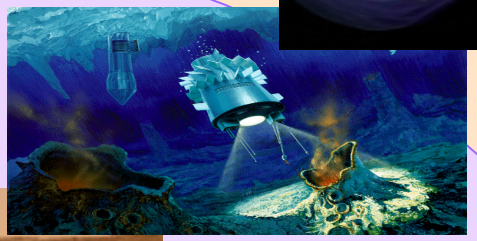
- The NASA Decadal Planning Team (DPT) evolved into the Exploration Team (NEXT)
  - Chartered in June 1999 to create a powerful new integrated vision and strategy for space exploration
  - Developed technology roadmaps to enable the science-driven exploration vision
  - Established cross-Enterprise, cross-Center systems engineering team (created a virtual Center)
  - Focused on revolutionary not evolutionary approaches
- NEXT Charter
  - Create an environment for discovery by integrating Agency plans and investment in the future
    - Collapse bureaucratic stovepipes
    - Use a systems approach

Overview
Stepping Stones

Go anywhere, anytime



Sustainable Planetary Presence



- Traveling out to ~1.5 AU, and beyond
- Enabling sustainable scientific research
- Sustaining operations on another planet
- Staying for indefinite periods

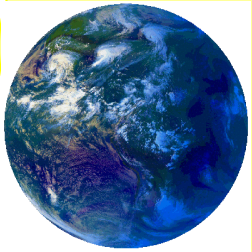
Accessible Planetary Surface

- Traveling out to 1.5 AU
- Enabling tactical investigations
- Visiting and operating on another planet
- Staying for 1-3 years

Earth's Neighborhood

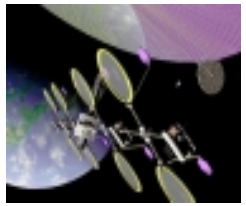
- Traveling up to 1.5 million km
- Enabling huge optical systems
- Operating in deep space
- Staying for 50-100 days

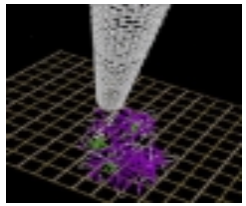
Earth and LEO



- Space Station experience
- Solar System learning
- Technology advancements

Enabling the Stepping Stones





The Hurdles

- **In-Space Transportation**
  - Safe, efficient, and economical
  - Multi-use, robotic and human capabilities
- **Crew Health and Safety**
  - Countermeasures to environmental effects
  - Medical autonomy
- **Human/Robotic Partnership**
  - Dramatically higher productivity, on-site intelligence
- **Affordable, Abundant Power**
  - Solar
  - Nuclear
- **Space Systems Performance**
  - Low-mass, self-healing, self-assembly
  - Automated reasoning, smart sensing, reliable

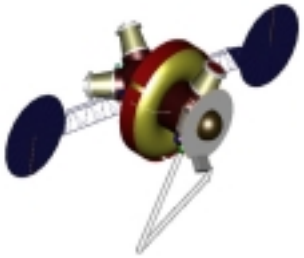
What must we know to make informed decisions?

The Criteria

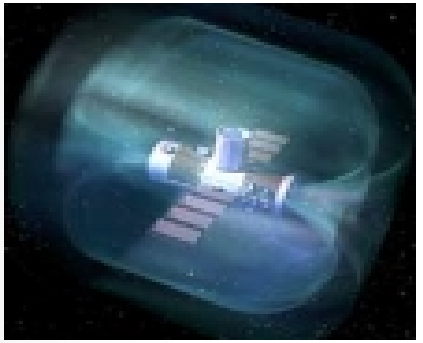
- **Acceptable knowledge about destinations**
- **Goals/objectives defined for optimal mix of robots and humans**
- **Certification of systems and/or crews for deep space operations**
- **Acceptable technology readiness achieved**
- **Reliable and plausible mission concepts**
- **High return anticipated**
  - Science impact
  - Education Benefits
  - Technology / Infrastructure
- **Partnership opportunities identified**

Overview
NEXT Approach

New Concepts and Current Technologies

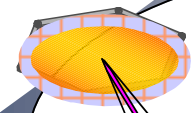


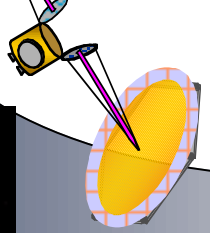
Create Innovative Concepts — and drive out Opportunities/ Needs for Revolutionary Advances in Technology



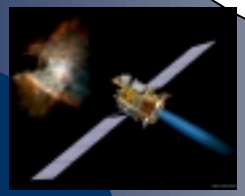
Revolutionary Concepts Using Breakthrough Technologies

New Concepts

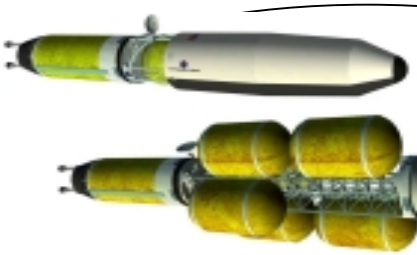




New Concepts Using New Technologies



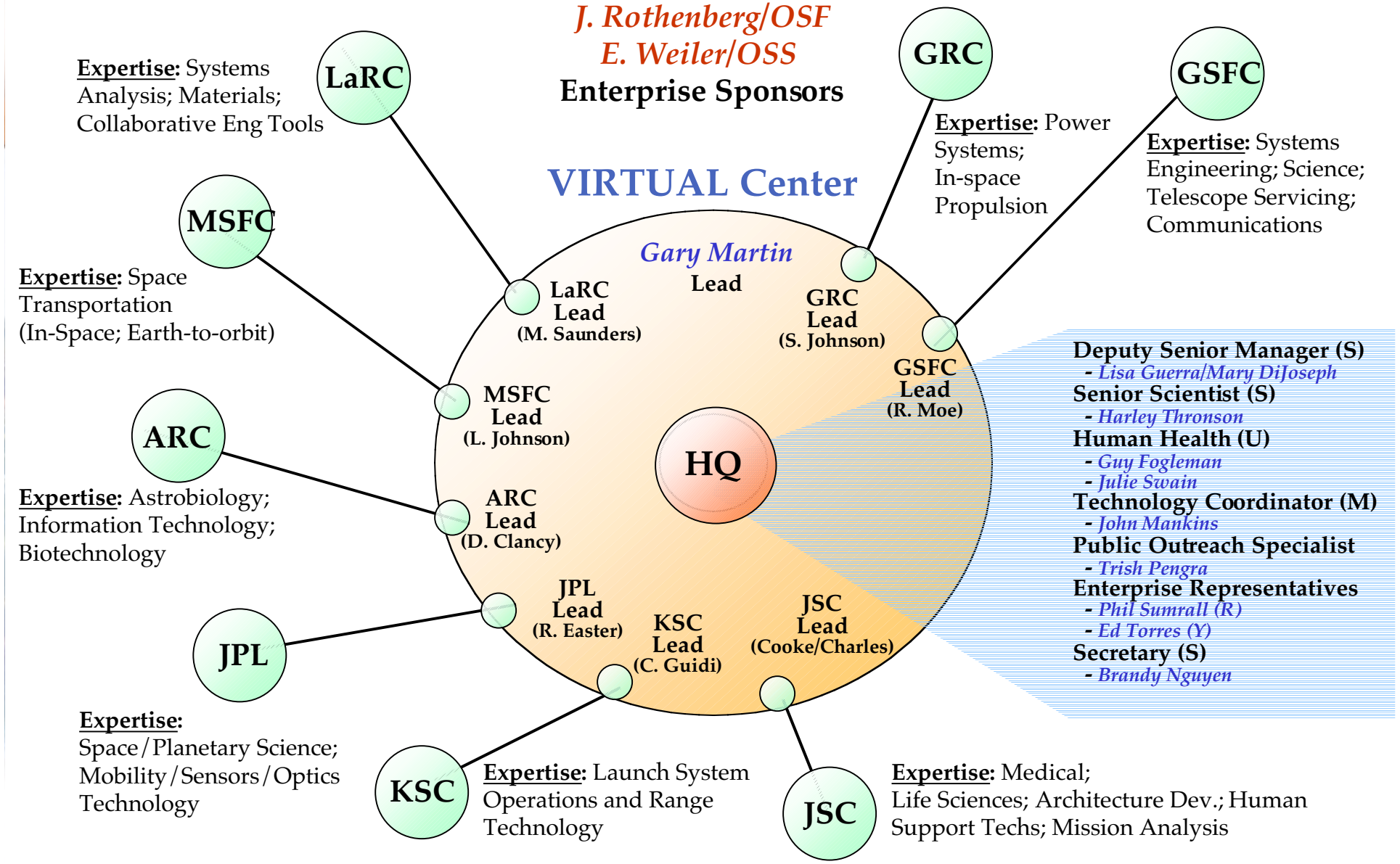
Current Concepts & Technologies



Current Concepts and New Technologies

New Technologies

Overview
NEXT in FY01

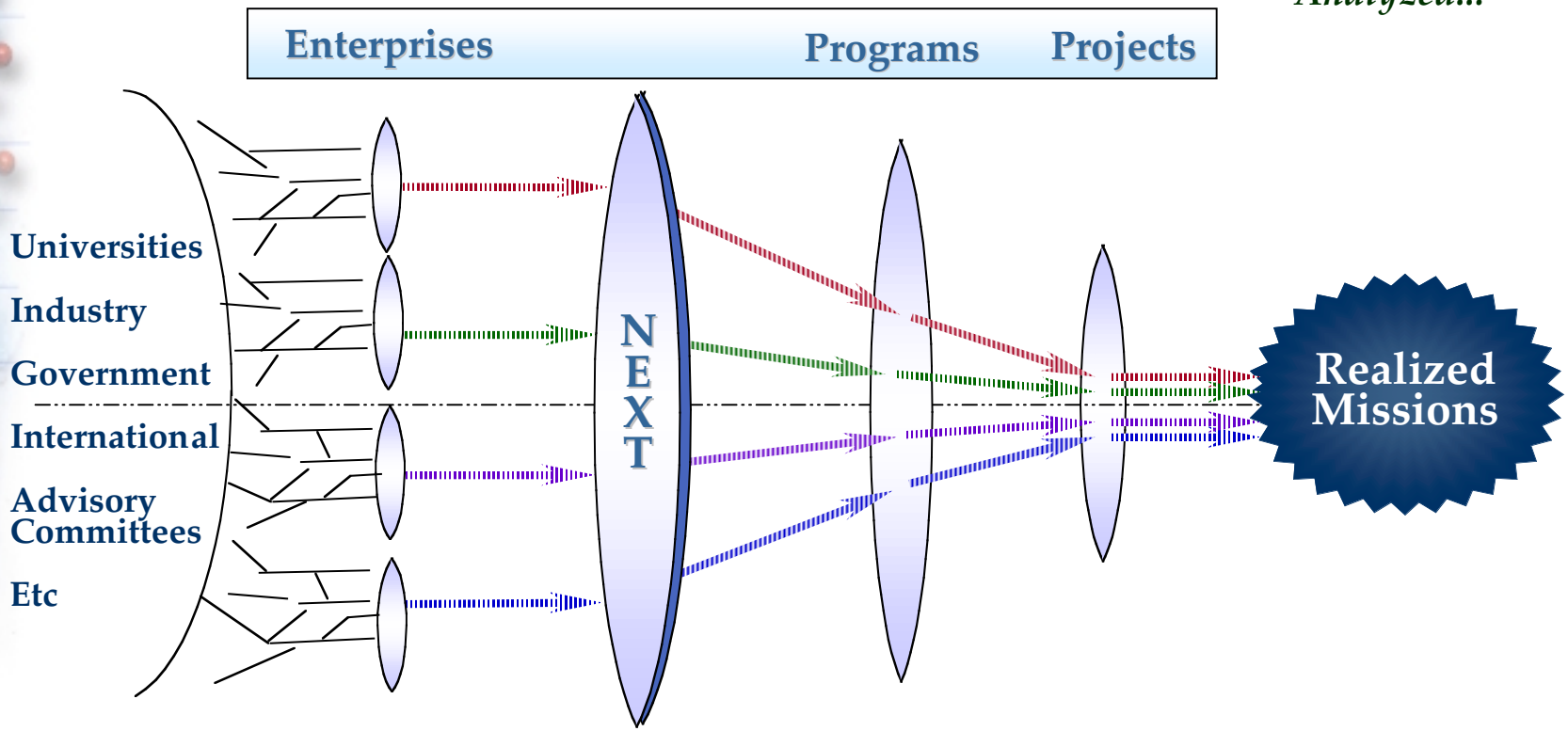


Overview

Why NASA Needs NEXT?

Initial Focusing → Final Focusing

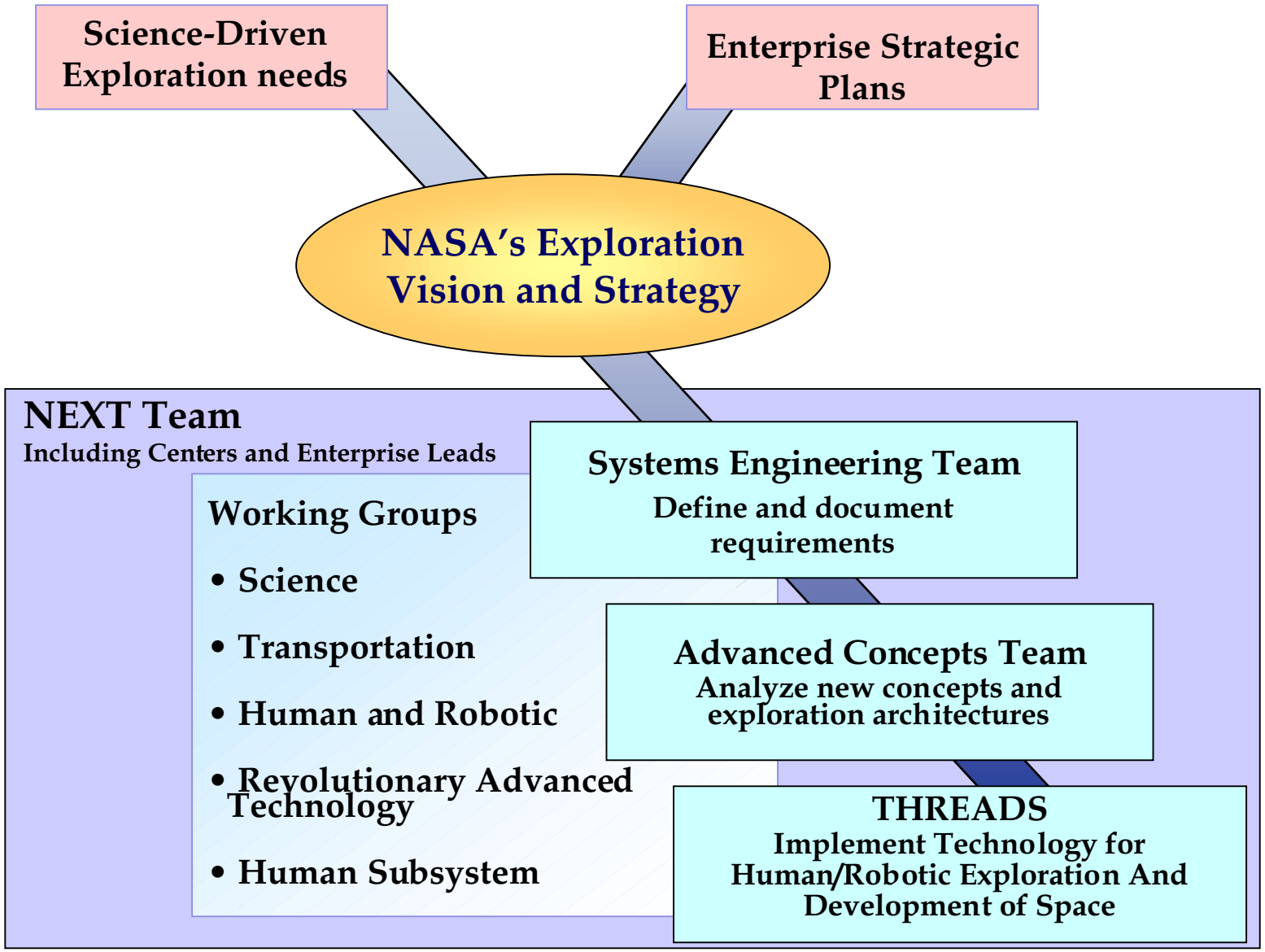
Combining the Best Synergistic Features of ~All Architectures Identified and Analyzed...



NEXT acts as a think tank for integrating new concepts and technology across NASA Enterprises

Overview

NEXT Systems Engineering Approach



Reports Available - NEXT Systems Engineering Plan and Requirements

Overview

Integrated Exploration

Strategic Focus	Progress in FY01
Driven by Science and Discovery	• Began to identify the best ways to use humans and robots through workshops and analysis • Performed analysis of integrated robot/human interactions for post 2010

Safety and Cost Conscious	• Continued research of breakthrough technology and concepts, e.g.
	  • Hybrid propellant Module
	  • Mini Magnetospheric Plasma Propulsion
	  • Interplanetary Highways

Progressive Approach	• Prioritized in-space propulsion technology across Enterprise needs • Focused on the first step: Earth's Neighborhood
Leveraging Partnerships	• Co-funded retroreflector rendezvous project with NRL • Identified collaboration through DoD Technology Area Review and Assessment (TARA)
Emphasizing Education	• Co-funded Steckler University grants on exploration and colonization • Sponsored graphics design class for students at the LA Art Center College, focusing on futuristic concepts for astronauts exploring space